nsstc.uah.edu/atmchem

Validating AIRS Ozone Measurements

Mike Newchurch[1], Mike Gunson[2], Bill Irion[2], Mohammed Ayoub[3]

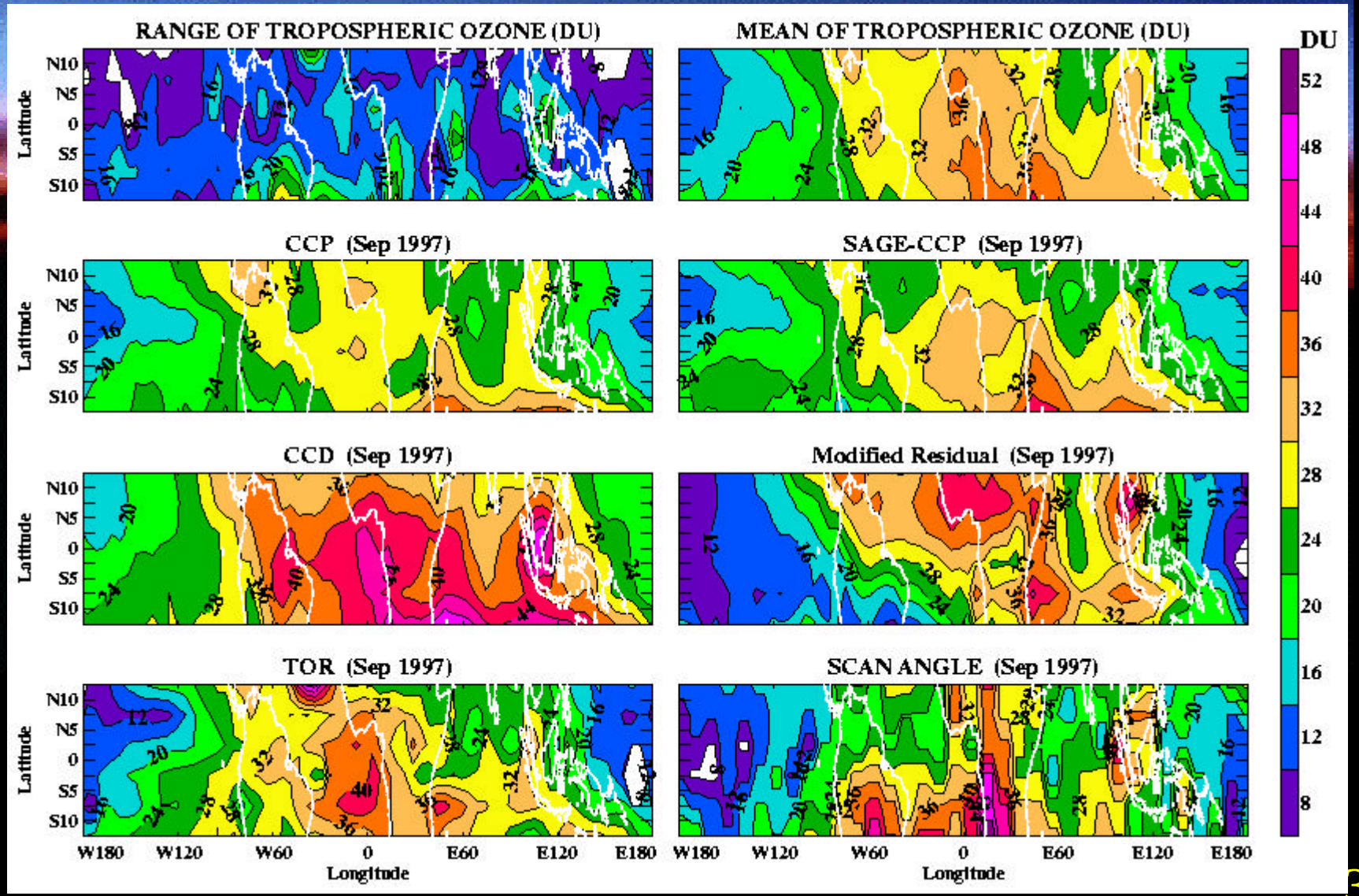
1. U. Alabama in Huntsville and NCAR/ACD, NSSTC 320 Sparkman Dr.,Huntsville, AL 35805 United States
2. JPL, 4800 Oak Grove Dr., Pasadena, CA
3. U. Alabama in Huntsville NSSTC 320 Sparkman Dr., Huntsville, AL 35805 United States

Motivation

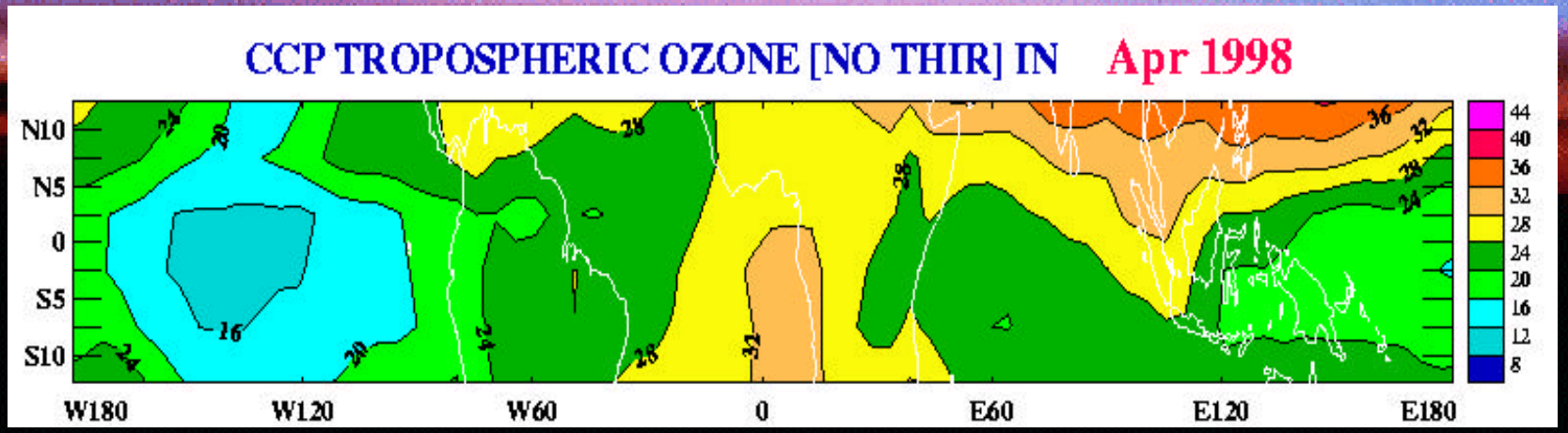
- Due to the limited temporal (weekly) and spatial (a few 10s of stations worldwide) coverage of ozonesonde measurements, Satellite techniques play an important role in deriving global tropospheric ozone.
- Current satellites:
  - EP TOMS is degrading, but still returning good scientific data.
  - SBUV/2 is experiencing significant calibration problems.
  - GOME is returning global column and experimental tropospheric ozone amounts.
  - TOVS/HIRS ozone column not widely used. Never accepted by the community.
  - QuickTOMS launch failed to reach orbit, instrument destroyed.
  - SCIAMACHY planned launch in near future.
  - OMI on AURA launch in about 2004.
  - AIRS (and TES) ozone column and profile data (day and night) would be very useful for continuity and tropospheric info.

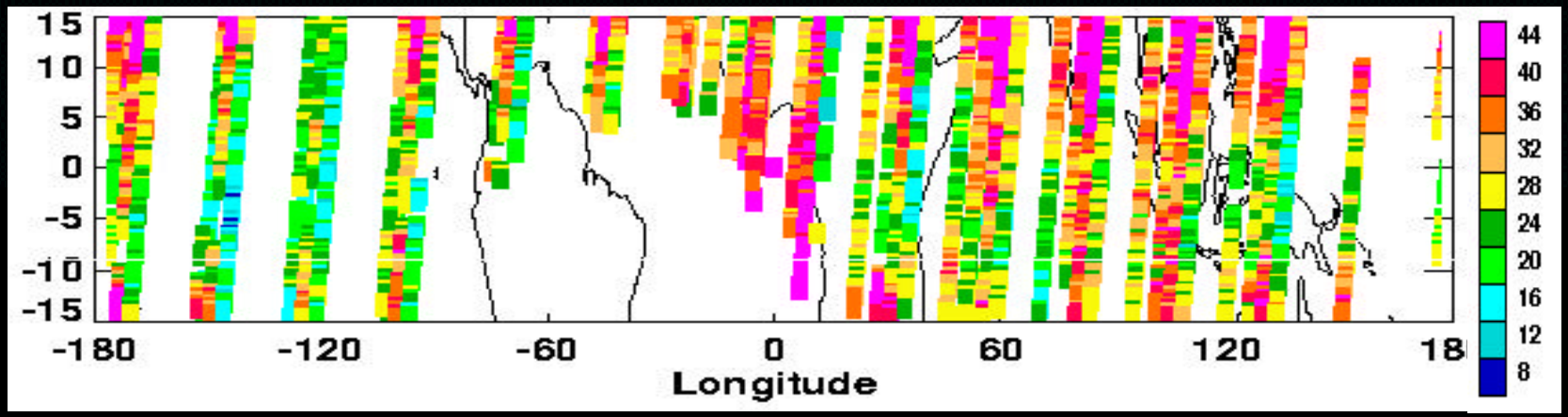
- The current various satellite retrieval methods vary significantly in their derived values of tropospheric column ozone.

Six TOMS-based Methods Comparison

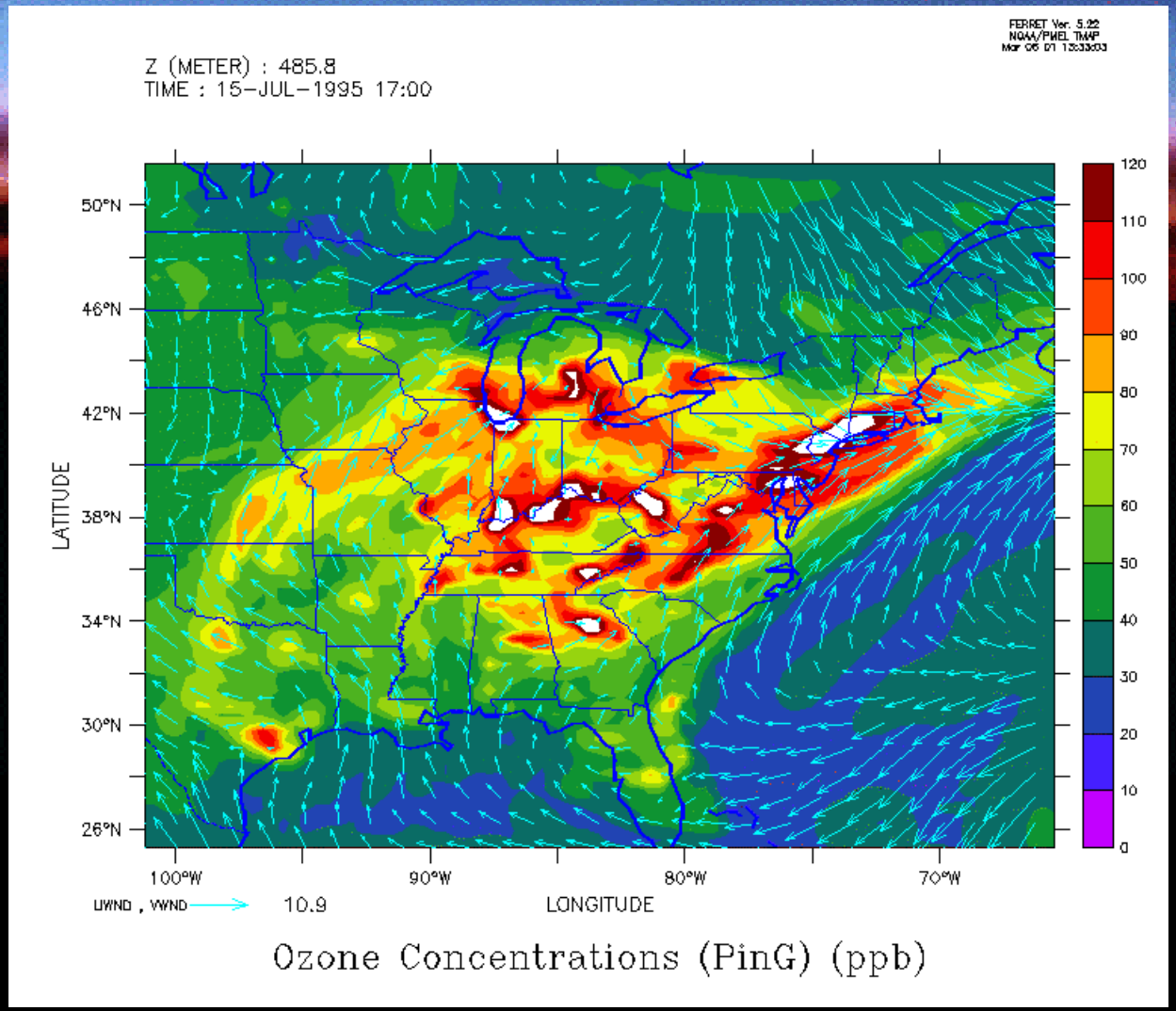


TOMS CCP Compared to GOME Tropospheric ozone





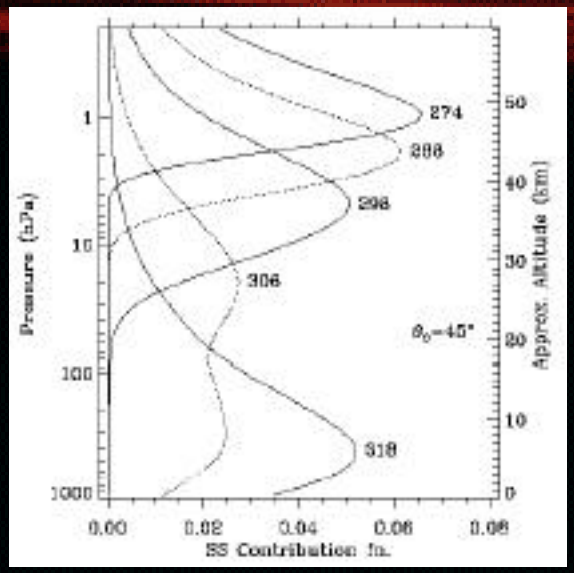
Models-3 Calculation of PBL Ozone: Diurnal Variation is very Large



Ozonesonde observations show significant variability

What the UV Satellite Sees

e.g., OMI, SBUV, TOMS, GOME



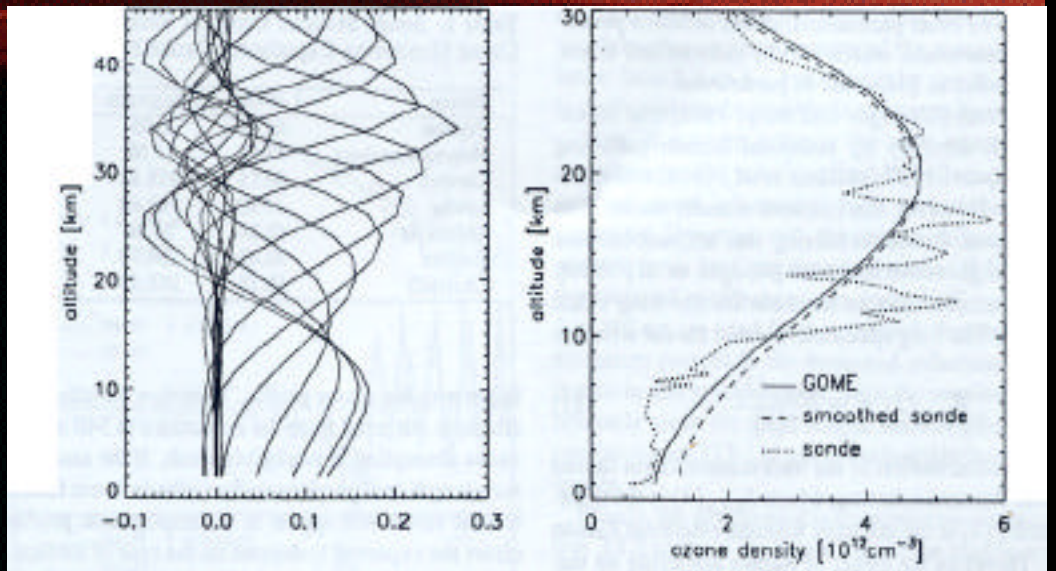


Figure 8. (left) GOME averaging kernel for Payerne, solar zenith angle = 70°. Different lines correspond to different rows of the averaging kernel. (right) comparison of retrieved profile (solid line) with smoothed sonde profile (dashed line). The dotted line represents the high-resolution sonde profile.

Bhartia, P.K., ed., OMII Algorithm Theoretical Basis Document Volume II: OMI Ozone Products, September, 2001

***Hasekamp, O. P., and J. Landgraf*, Ozone profile retrieval from backscattered ultraviolet radiances: The inverse problem solved by regularization. J. Geophys. Res., 106, 8077-8088, 2001.**

What the IR Satellites Sees

e. g., AIRS, TES

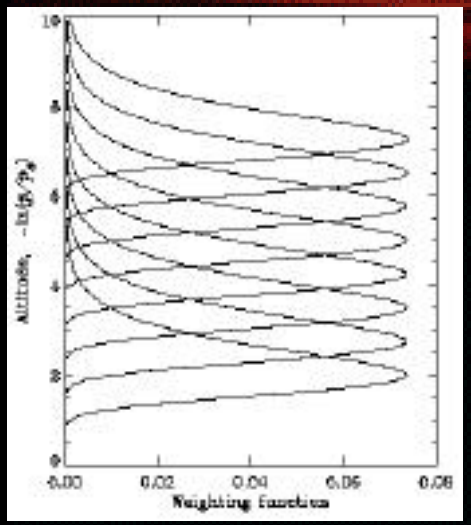


Fig. 1.1: A set of synthetic weighting functions representing a typical nadir sounder measuring thermal emission. (**fix scale so ♥ K*dz* = 1)

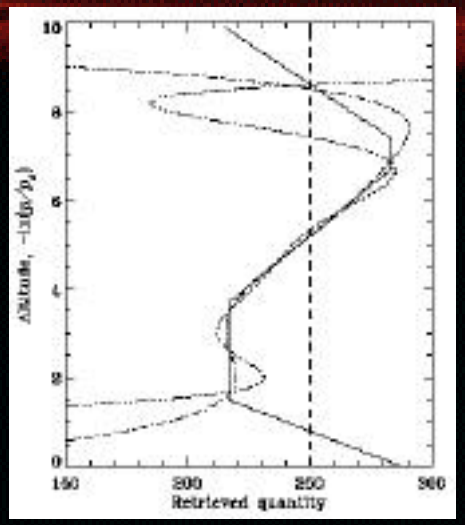


Fig. 1.2: Simulated retrievals using the weighting functions of Fig. 1.1 and a polynomial representation. (a) The original profile; (b) An exact retrieval with no simulated experimental error; (c) An exact retrieval with a 1% simulated experimental error.

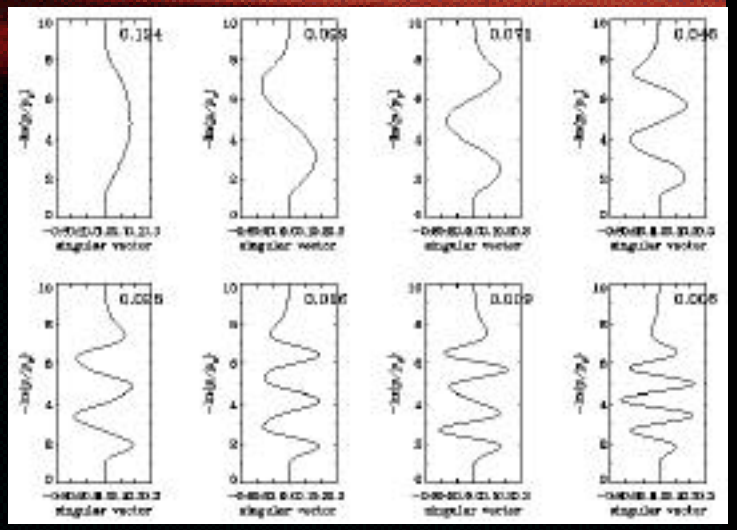


Fig 2.2: The singular vectors of the weighting functions of Figure 1.1. The corresponding singular values are given in each panel.

Rodgers, Clive D., Inverse Methods for Atmospheric Sounding: Theory and Practice

The AIRS Ozone Validation Plan

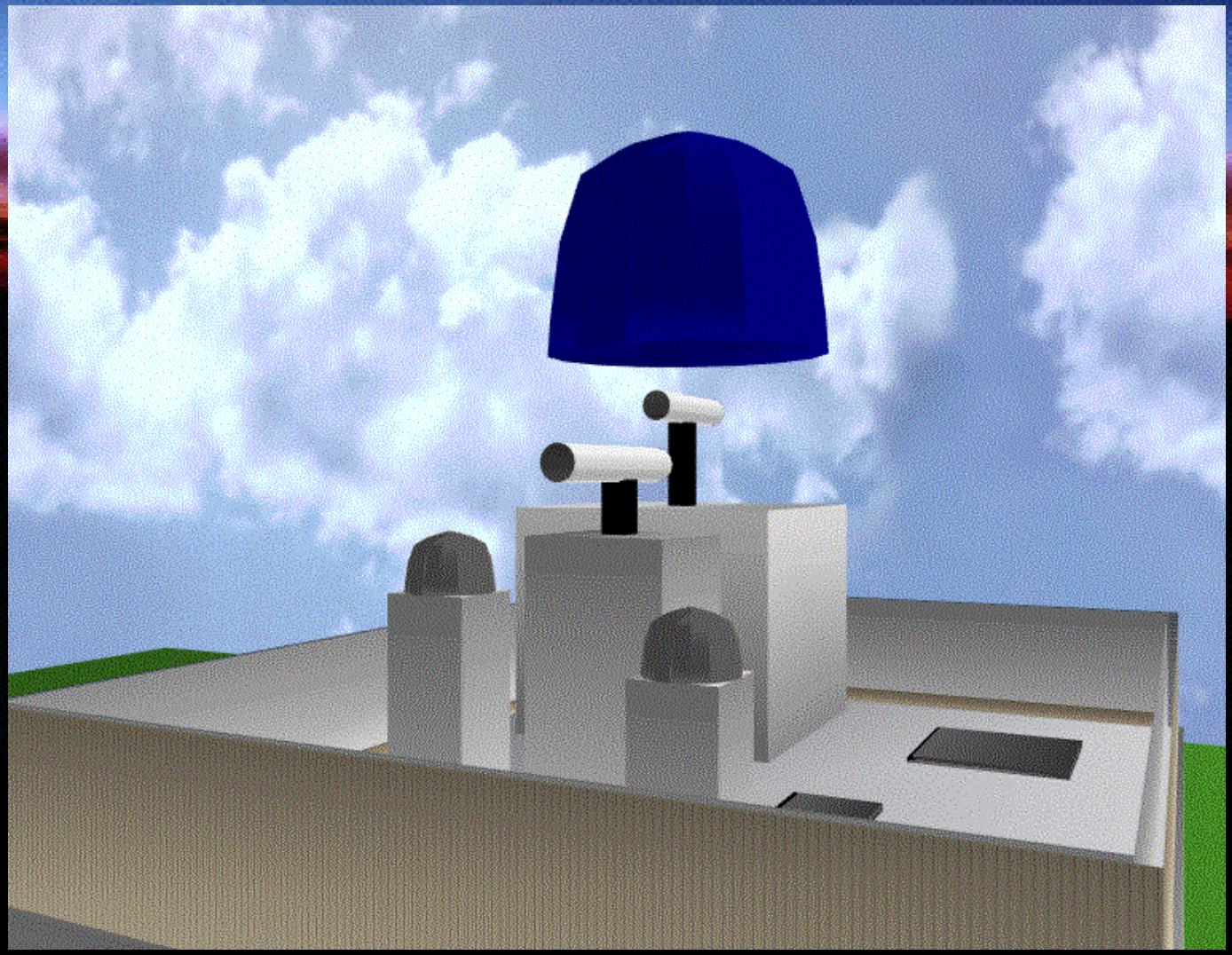
In the first year, we will assess the total ozone column measurements with Dobson measurements in the most benign atmospheric conditions. Then, with dedicated ozonesonde launches at the Southern Great Plains ARM/CART site, in conjunction with the AIRS intensive validation campaign, we will focus sharply on the accuracy of the ozone retrievals over more difficult conditions including partly cloudy scenes, day/night differences, and difficult viewing geometry.

In the second year, we will introduce additional standard correlative data (Umkehr, TOMS, SAGE, lidar) to assess the precision and accuracy of the tropospheric and stratospheric columns and extend the domain of comparison in both time and space. We will also focus on day/night differences using dedicated ozonesonde launches (and possibly lidar) at Huntsville, AL.

In the third year, we will investigate the accuracy of AIRS to measure Stratospheric/Tropospheric exchange morphology and convective boundary layer diurnal differences. We will also place the AIRS measurements into the context of derived tropospheric ozone fields and of global 3-d chemical transport models to assess our understanding of tropospheric ozone morphology.

RAPCD Lidar and FTIR Labs

RAPCD Penthouse perspective



nsstc.uah.edu/atmchem

UAH Atmospheric Chemistry - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://vortex.nsstc.uah.edu/atmchem/

UAH The University of Alabama in Huntsville

atmospheric *chemistry*

home | directory | publications
contact | links | search

- Huntsville Ozonesonde Station
- Large Eddy Simulations
- Regional Atmospheric Profiling Center for Discovery (RAPCD)
- SAGE II Stratospheric NO2
- SAGE II Stratospheric Ozone
- Stratospheric Ozone Trends
- TOMS Tropospheric Ozone
- Classes
- Data
- Recent Events
- Student Opportunities

UAH | ATS | ESSC | GHCC

Contact: Leanne McAllister